PREMATURE PERSONNEL ATTRITION IN THE U. S. MARINE CORPS

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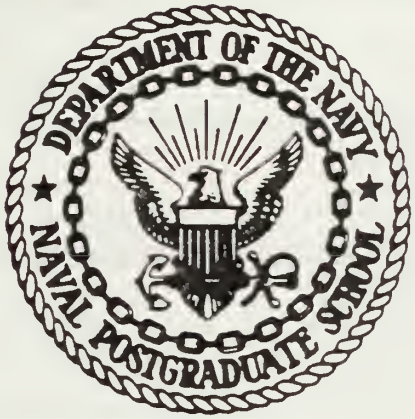

THESIS

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U. S. MARINE CORPS

by

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20. Abstract (Cont'd)

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by

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ABSTRACT

This study examined the problem of premature discharges of non-prior service male enlisted service members due to their failure to meet minimum behavioral or performance criteria. Based on records of all first-term male enlisted Marines discharged in FY '75 or '76, probabilities of successfully completing enlistment (avoidance of adverse discharge) are calculated for various subgroups of Marines based on demographic factors. The findings of previous studies are generally supported. In addition, geographic location of home of record in connection with education level was found to have a significant bearing on success rates. Possible uses of this information are pointed out in connection with establishment of accession policies and allocation of recruiting assets.

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I. INTRODUCTION

Personnel attrition, the separation of enlisted members prior to their expiration of active service (EAS), has come to be recognized as a serious drain on the Marine Corps' most precious asset, its manpower. Of those Marines who enlisted in the Marine Corps during Fiscal Year 1971, 25.1% were discharged early, either the result of disciplinary action or administratively for failure to meet minimum behavior and performance criteria. Furthermore, Reference 1 indicates that this trend is continuing and that the Marine Corps is not unique in facing this problem. All four services are suffering similar rates of non-EAS attrition.

While it is difficult to ascertain whether or not the elimination of the draft in 1972 was a cause of increased attrition rates, there is little doubt that it has affected the seriousness with which the problem is viewed by Department of Defense manpower officials. The cost of personnel failures within the service has risen dramatically as a result of increases in funds needed for recruitment and increased military pay and training costs.

No up-to-date estimates of these costs were available from the Marine Corps at the time of this writing. However,

some cost estimates of this problem in the Navy have been developed and are presented here to give the reader a general idea of the importance of the problem. It is not unreasonable to assume that costs to the Marine Corps caused by non-EAS attrition are of the same general magnitude. Reference 2 estimates the dollar costs of recruiting and training a replacement for a service failure to be $2350 for a man who receives no formal schooling beyond recruit training and from $7112 to $10,112 for a man who receives additional schooling or apprentice training. It should be understood that these costs do not include those that would accrue from empty training seats and fleet billets, not to mention disruptive effects on morale and disciplinary, administrative, and supervisory costs of handling substandard performers.

Stephan, et.al. in Reference 3, a 1972 study based on 1967-1970 attrition rates (which averaged 14.3% of accessions), determined that the Navy, in order to maintain a force of 300,000 effective individuals in the second through fourth years of service, would annually have to recruit, train, and pay, for various lengths of service, an additional 12,612 men above steady-state requirements. The cost of this higher force level, necessary to provide for attrition, was estimated to be $86 million above that of a force level with no attrition. Assuming a Marine Corps attrition rate of

25% and an accession rate of 50,000 annually and allowing for inflation of military pay at an assumed rate of 5% annually, the increased cost of maintaining the necessary force level traceable to personnel attrition in the Marine Corps is presently something in the neighborhood of $73 million per year. This estimate is still conservative because it assumes that an individual is as productive as his peers until the day he is discharged.

The precision of the above estimate is not of concern here. The general magnitude however provides considerable incentive to be interested in the problem of personnel attrition and to seek to find ways to cut the attrition rate, or at least to decrease the cost of attrition. Some general approaches to this end which will be addressed in this study are to improve screening at recruiting centers and recruit training depots and to cut the costs of recruiting by increasing efficiency.

II. LITERATURE REVIEW

Most of the literature that pertains to the personnel-attrition problem in the Armed Forces consists of empirical studies that analyze data from actual service attritions as to the demographic characteristics of the individual failures and generalize from these attrition samples, determining probabilities of success or failure for men with like characteristics. The following review is presented to indicate the nature and scope of research that has been conducted on this subject.

The point of departure for most modern thought on the subject is Reference 4, a 1968 study by Plag, based on data from men who entered the Navy in 1960. This study examined attrition rates in relation to education, mental ability, and other factors and confirmed earlier findings that there is a large disparity between the attrition of high school graduates and non-graduates. From this study came a table of "Odds for Effectiveness" which was used by Navy recruiters until quite recently to help judge the relative desirability of potential recruits based on their characteristics and the associated probability of their completing the terms of enlistment. Reference 5 is a 1970 study by Plag that

again studied the problem of personnel attrition. In this instance, his sample consisted of 3156 "new mental standards enlistees" in the Marine Corps. These individuals, who would previously have been denied enlistment into the Marine Corps on the basis of low Armed Forces Qualification Test (AFQT) scores, were admitted under the provisions of "Project 100,000," a DOD-wide program designed to offer opportunities to disadvantaged young men. The study analyzed the success of these men in completing their service in an effective manner by studying pre-enlistment and recruit-training variables. The results indicated the following variables to have some predictive validity: years of education, GCT scores, parents' marital status, age at enlistment, race, and aptitude test scores. From this information "Odds for Effectiveness" tables were again prepared for recruiter use. However, improving the success rate of these "new mental standards" enlistees from an overall rate of 60% to a rate of 70% solely by using this table would have required rejection of about 48% of them.

It must be remembered that the above studies were conducted using data taken from periods in which a substantial number of enlistments in the Navy and Marine Corps were draft-induced. Concurrent with the move to an all volunteer force were an increase in the costs associated with attrition

and an increase in the attrition rates themselves. In 1972, Stephan, et. al [Ref. 3] studied Navy and Air Force personnel attritions over the 1968-1971 time frame and concluded that loss rates due to disciplinary and administrative problems depend much more on high school graduation than on mental group. Although this essentially confirms Plag's findings, changes in magnitudes of loss rates led Stephan, et. al. to conclude that a complete revision of the "Odds for Effectiveness" was in order. The need for improved statistical record-keeping on all accession and discharges was also pointed out.

In 1973 Carpenter and Christal examined in Reference 6 the entire enlisted male input in the Air Force from 1958 to 1969 considering only undesirable types of discharge. They found that loss rates varied with mental group, high school graduation, and age. Consistently, across all mental categories, high school graduates exhibited much lower loss rates for undesirable causes.

Reference 7, by Boyd, et. al., indicates that a very similar pattern existed in connection with desertions among Army accessions who enlisted in Fiscal Years 1968 and 1969. In particular, and in order of importance, deserters were, relative to non-deserters, less well-educated, younger at enlistment, lower in AFQT score, more likely to be from

the South or Mid-Atlantic region, of a minority race, and in a less skilled military occupational specialty (MOS).

One of the main impacts of the above studies was an improvement in record-keeping in all the services in order to facilitate improvements in future study efforts. While no studies of the attrition problem were reported in 1974, it is apparent that the impact of personnel attrition was being felt. For in 1975, some very useful studies were published.

Reference 8 by Haber is directly related to the Marine Corps personnel-attrition problem. It used as the data base all individuals who entered the Marine Corps during 1968. This file contains a statistical record with significant historical information for all first-term enlistees from initiation into active duty until separation from service or reenlistment. Haber attempted to quantify the impact of several variables as they affected early attrition of first-term enlistees. Using contingency table analysis he examined age at enlistment, race, county population of the enlistee's home of record, education, length of enlistment, mental group (as indicated by score on the General Classification Test), MOS, and region of home of record. The principal findings were that high school graduation is the most important variable in indicating successful

completion of enlistment. Holding all other variables constant, the retention rate of high school graduates was about 30% higher than that of non-graduates.

Since this cohort file permitted convenient analysis of the times until discharge, the discovery of other interesting results was possible. Haber thus found that, other things equal, two-year enlistees were more likely to complete two years of service than were four-year enlistees, particularly for non-high school graduates.

The only variables examined in this study which were found to have no influence on attrition were county population and geographic region. However, the level of aggregation was high in geographic region as only North, East, South, and West were compared. There was likely as much variation within these regions as among them. The county population variable should not have been expected to be meaningful in any case because it explicitly included no indication of county size. Perhaps population density would have been more revealing.

Haber's conclusion included the inference that while it may appear to be comparatively inexpensive to acquire high school non-graduates there may be significant hidden costs associated with such a policy. He suggests that the derogatory effects on unit discipline and morale, resulting from

ch negligible or negative contributions of significant
mbers of enlistees dropping by the wayside, may be quite
ious.

Having identified some factors related in a negative
ese to success of enlistees in the Marine Corps, Haber
ae the important next step of examining in Reference 9
o these factors might be related to a positive indication
f success. This study used the same data base and factors
s previously [Ref. 8] to determine what relationships
xst between demographic variables and "trainability" in
n Marine Corps, as indicated by earlier-than-average
motions. His principal finding was that, for enlistees
complete their enlistment, high school graduation is
etter prediction of job performance and productivity
n mental-test score. In fact, high school graduates
lower mental groups exhibited a higher level of perform-
e as indicated by promotions than did non-graduates in
her mental groups. This finding, in conjunction with
finding that graduates are more likely to complete
ir enlistment, allows the more general conclusion that,
d separately, high school graduation is a more important
dstick of the potential effectiveness of a prospective
istee than are scores on tests of mental ability.

Reference 10 is an examination by Goodstadt and Glickman of the problem of enlisted attrition in the Navy and Marine Corps from a slightly different point of view. They provided some cursory analysis of the magnitude of the problem and its recent trends. Of interest here was the finding that the largest proportion of non-EAS (Expiration of Active Service) attrition occurs during the first two years of service, the bulk of which is attributed to unsuitable behavior. Another finding was that patterns of increasing job mobility are also present in the civilian sector of this age bracket in our society, but here direct comparisons are dangerous because no contractual employment exists in that sector. Of more general interest was the observation that examination of manpower data, like the studies just discussed, will not reveal the causes of attrition if they are organizational climate factors or policy variables within the services. In other words, such studies can only result in conclusions that will relate to screening of personnel, whereas more efficient solutions to the attrition problem may lie in internal management and leadership actions.

The capstone of the currently available literature on enlisted-personnel attrition is Reference 11, a 1976 study by Lockman, Jehn, and Shughart, which develops models for

both enlisted attrition and recruiting-district performance. The data base was a cohort file of all 1973 US Navy non-prior-service recruits. The variables of education, mental group, age, race, and whether or not the individual was responsible for any dependents were broken down into a total of fifteen categories for which dummy variables were defined, resulting in 180 possible groups of observations, 148 of which actually contained individuals. Loss rates were then estimated for each group. The result was prediction of survival rates for the first year of service with a standard error of only two percentage points. In general terms, the results provided further confirmation of previous notions that high school graduation is far more important in predicting survival of the first year of service than is mental test score. However, the currency (the accession data base was not significantly affected by draft pressure) and improved comprehensiveness and apparent accuracy of this model made it a substantial improvement over the "Odds for Effectiveness" model previously in use.

In Reference 12, a further study by Lockman, the accuracy of the Lockman model was checked against first-year attrition rates of CY 1974 Navy accessions. The result was a high correlation (r^2=.95) between predicted and actual loss rates. The difference noted was that race and dependency were not

statistically significant predictors of attrition for the 1974 accessions. The 1973 accession cohort was also examined to determine loss rates at the end of the second year of service. Here the same general patterns emerged as in the first-year, except that after 2 years, the race variable again dropped out. The conclusion here was that there is no significant difference in the attrition rates of minority and majority sailors.

Table I is included to show relative loss/survival rates for Navy enlisted personnel after two years of service, as determined by Lockman [Ref. 12].

Table I

PREDICTED TWO-YEAR SUCCESS CHANCES
BY QUALITY CATEGORY (NAVY)

High School Education	School Eligibility (by Mental Group)	Success Chances (per cent)
Graduate	Eligible	81.8
Non-graduate	Eligible	62.3
Graduate	Ineligible	70.7
Non-graduate	Ineligible	49.8

The most striking thing about these results is the fact that, on the average, high school graduates from lower mental groups are more successful than non-graduates with high test scores (70.7 vs. 62.3).

Recognizing this finding, Lockman in Reference 13 went a step further to determine success rates for non-graduates who had attained a Graduate Equivalency Diploma (GED) certificate. This was deemed desirable because if holders of GED certificates were to exhibit success rates close to those of high school graduates, then the recruiting base for individuals with high success rates could be expanded somewhat. Although difficulties were encountered because of apparent errors in the data base, Lockman was able to conclude that from the CY 1973 cohort the average GED first-year success rates fall midway between those of men with high school diplomas and those who had no degree. There was little dispersion from this average across age groups and mental groups, except for mental group IV which showed lower success rates. These results are not considered entirely conclusive because of the noted errors in the data and because no allowance was made for differences in GED requirements, which actually are not uniform but vary widely from state to state.

Before departing from a discussion of this literature it is necessary to place the results of References 11, 12, and 13 in perspective. Reference 14 points out that such results may be misleading if they are used to predict the success rates of individuals; for the models were developed

by grouping individuals by their characteristics and computing the mean probability of success for each group. While such models achieve high correlation coefficients and small standard errors, it is important to understand that such statistics refer to the means for the groupings rather than for individuals. There were of course, numerous individual servicemen who performed in an entirely successful manner, but who would have been given poor chances (probability) of success based on the factors considered. Nonetheless, such probabilities can be very useful in establishing policy.

III. RATIONALE FOR FURTHER RESEARCH

The foregoing has indicated some of the reasons for studying the problems of personnel attrition in the Marine Corps. At this point it seems useful to discuss these issues in connection with their management implications and theoretical origins in order to channel this research and provide a basis for a better understanding of the findings.

A. AN UNDERSTANDING OF THE PROBLEM

It is essential that leaders and manpower officials of the Marine Corps have an appreciation for the extent, if not the underlying causes, of this problem of premature separation from the service. Broadly, this can be interpreted as meaning simply that a leader must know his organization. If something as significant as this phenomenon in terms of men and costs exists, then leaders must be aware of it whatever the causes. While the search for remedies will be addressed below, some basic knowledge and understanding of any problem is preliminary to any solution to that problem.

Planners unaware of this attrition phenomenon could never make satisfactory estimates and plans for future

manpower levels. Accurate budgeting is seriously degraded if impacts of personnel attrition are not considered in relation to pay and allowances and recruiting expenses. Training officials must include some factor for attrition in determining school quotas. Policy makers must understand the working-level effects that attrition has on their policies and the effects that efforts to deal with or control attrition have on operating-level organizations. Probably most important, leaders, particularly at the higher levels, must be aware of the effects that high rates of personnel attrition have on the readiness of their forces.

B. THE SEARCH FOR REMEDIES

Awareness of the personnel attrition problem leads logically to a search for solutions. Is this attrition controllable? To the extent that non-EAS attrition includes such things as death and medical discharge there is probably little that can be done to cut attrition. To the extent that it includes such things as transfer to officer programs, it is certainly undesirable to limit attrition. However the majority of non-EAS attrition today is of a different ilk. Such things as disciplinary discharges, administrative discharges due to unfitness or unsuitability, and discharges relating to recruiting errors are predominant in

today's high rates of attrition, and they may be subject to some form of remedy.

1. Internal Environment and Policy

Goodstadt and Glickman [Ref. 10] have suggested that many of the reasons for personnel attrition derive from societal factors encountered in the serviceman's environment. This implies that many of these service failures are the result of discretionary behavior on the part of the individual, a definite possibility in most administrative discharges. This conclusion is consistent with the results summarized in Reference 15, which concluded that lack of job satisfaction was strongly related to worker turnover and absenteeism in the civilian sector. It is logical that premature separation from service is the military equivalent of civilian worker turnover, and further credence is given to this comparison of the problems of military and civilian sectors by the currently high rates of absenteeism in the Marine Corps. The search for solutions to this aspect of the attrition problem is continuous. It is the conscious effort of Marine Corps leaders at all echelons. Leadership remedies to Marine Corps personnel attrition problems are not addressed further herein. Nonetheless leadership remains one key to the overall solutions.

Before departing from the subject of reducing attrition through internal policy, we should note that, just as attrition may be discretionary on the part of the individuals concerned, it is also discretionary to some extent on the part of Marine Corps leaders and managers. Various policy alternatives exist that will result in changing attrition rates. Discouraging the submission of administrative discharges through moral persuasion of administrators or tedious administrative requirements will reduce attrition rates as will explicit limitations on the numbers of such discharges that may be approved. Such policies, however, are certain to have serious impact on the quality of the manpower force. Closing the outlet valve is likely to do little more than trade one highly visible problem, a high attrition rate, for another problem. The problem of reduced quality and discipline in the ranks, while less apparent in terms of end strengths and attrition rates, is likely to be the more serious in terms of combat readiness. Thus a simple solution to a complex problem may not be a solution at all.

2. Screening and Recruitment Implications

Several of the studies already discussed had an odds-for-effectiveness or probability-of-success orientation. They were designed for use by recruiters as a tool for

screening of enlisted applicants. The extent of screening that can be conducted by recruiters is dependent on the recruiter's production quota and the supply of applicants. If the supply is great relative to the quota, obviously the recruiters could accept only those with the greatest predicted chances of completing their enlistment, the high school graduates from higher mental groups. Normally the situation is very different, and the use of the tables is probably limited to a few cases each month when the recruiter decides which of a relatively few men to accept to meet the quota. Alternatively, such odds for effectiveness can be used by policy makers in establishing quotas. For instance some of the services have recently mandated increases in the percentage of high school graduates among enlisted accessions. Such requirements are based, at least implicitly, on the odds and probabilities developed and refined in the last few years.

Beyond such "rule of thumb" applications, the potential impact of attrition data and success rates is less clear. One area that offers promise is the use of such data as a quality factor in determining the optimal allocation of recruiting efforts across regions. In particular, there is merit, at least theoretically, in the inclusion of a quality factor when comparing the recruit production of different

Recruiting Stations. The success rates of recruits from these stations can be used as this quality factor.

References 11 and 16 both addressed the problem of optimal allocation of the most obvious vehicle of recruiting effort, the recruiters themselves. It is stated that, at the optimal allocation of recruiters, the marginal product of recruiters in each region will be equal (marginal product being the increase in enlistments due to the addition of one recruiter to the region). This follows from economic theory. However, strictly speaking, that theory does not apply unless the product is homogeneous across regions: the enlistees must be exactly the same in each region. It is more correct, then, to include a quality factor for each region when evaluating the marginal product of the recruiters.

Indeed, there are measurement difficulties which compound the problem. The use of an average success rate for a region in computing a marginal product cannot be rigorously justified because just as adding more recruiters to a territory results in decreasing returns in terms of enlistments per recruiter, it is reasonable to expect also that as an area is more and more saturated with recruiters there may be some difficulty in maintaining a specified level of quality. Furthermore, as Haber, et. al., point out [Ref. 16], equating net productivity figures (the number

of recruits per recruiter who complete training or complete their enlistments) across regions still will not ensure optimality because the cost of the failures must be considered an additional input.

As complicated as the allocation problem is, it does not seem justifiable to ignore the quality factor without first checking to see if there are any significant differences across regions. Any such differences are likely to have a large effect on a solution to the allocation problem because, when these marginal products were evaluated without a quality factor in 41 Navy recruiting districts [Ref. 11], the mean of all marginal products was only 2.20 and the range was also small (1.28 to 2.76), indicating that the potential for increased quantitative efficiency through reallocation of recruiter assets was quite small. The use of quality factors based on previous attrition or success rates of enlistees from the various regions would surely put these marginal productivities in better perspective. These quality differentials, if they exist, should also have similar implications for the allocation of other forms of recruiting expenditures such as advertizing.

Finally, if success rates can be determined down to a reasonably small region, then managers of the Recruiting District will have some additional information at their

disposal with which to evaluate the historical production of fairly specific localities. It is at least potentially feasible to determine attrition rates down to the county level, provided a sufficient number of men have been enlisted from the county. The time lags involved do not permit the use of this type of information to evaluate the performance of particular recruiting personnel, but such data could serve to assist recruiters in understanding their territories.

IV. DESCRIPTION OF ANALYSIS

The objective of this research was to analyze personnel data residing in magnetic tape files at Headquarters, Marine Corps, in an attempt to shed further light on the characteristics of that portion of the enlisted population that fails to complete a full term of service for adverse reasons indicative of poor personnel quality. Knowledge of these characteristics might be useful in manpower planning and policy determination as outlined in Chapter III above.

A. DATA

The data for this study was provided on a computer tape by the Manpower Management Research and Measurement Section at Headquarters, U.S. Marine Corps (HQMC). The tape, containing statistical records of Marines discharged from service during Fiscal Years 1975 and 1976, was extracted at HQMC from the files of the Transaction Retrieval System (TRS), a subsystem of the Marine Corps Manpower Management System. The TRS is a historical file that records certain transactions which are reported on the Unit Diary Report by each Reporting Unit Command (normally the company level). The Unit Diary includes reports of every official transaction that affects any member of that command, such as promotion,

transfer, absence, and, of interest here, discharge. The report of a discharge results in the building by the computer facility of a 240 byte statistical record that identifies in detail the Marine who was discharged. The attrition tape here included such a record for every male Marine who was discharged from his first enlistment during Fiscal Year 1975 or 1976 for any reason.

From this group, those discharges which resulted from circumstances indicative of substandard personnel quality or undesirable conduct were singled out by means of a separation code on the record. In order to maintain some consistency with other studies and current Marine Corps policy, the definition of this group of interest as used here is the same as that used by the Manpower Planning Programming and Budgeting Branch (MPP) at Headquarters, Marine Corps. The actual codes are listed in Appendix A. The types of discharges considered here include all punitive discharges, as well as those administrative discharges related to character or behavior disorder, motivational problems, enuresis, inaptitude, alcoholism, discreditable incidents (civilian or military), shirking, drugs, financial irresponsibility, unsanitary habits, civil court conviction, security, fraudulent enlistment, homosexuality, sexual perversion, good of the service (in lieu of Court Martial),

and other reasons indicating misconduct, unfitness, and unsuitability.

The specific selection by MPP of those codes to be considered is based on judgment and is necessarily somewhat arbitrary. Certain other causes such as hardship or the Vietnam-related clemency program might have been included; however, the difficulty of interpreting results, coupled with the small number of observations or the temporary nature of the problem, makes the desirability of the inclusion of these causes somewhat problematic. Of the 102,542 discharge records examined, 674 were deleted because they indicated the discharge occurred prior to FY 1975, leaving 101,868 records of Marines discharged in FY 1975 or 1976. Of these, 37,287 were coded to indicate one of the causes considered here to be adverse. It is this group that is of primary interest because the problems they generate are out of all proportion to their numbers.

The 240 bytes of each record contain a wealth of information that identifies each Marine discharged. The data fields used in this study were civilian education level, mental group based on Armed Forces Qualification Test percentile scores, age, race, and state and county home-of-record. Some additional fields were also examined for each record in order to determine whether or not the data

was as purported to be. The items checked were date released from active duty, separation designation code, length of enlistment, military occupational specialty at discharge, reporting unit command at entry and discharge, monitored command code at discharge, program enlisted for, source of entry and GCT. Although there were a few irregularities in some of the distributions examined, there was no trend in the errors so as to imply some bias due to incorrect selection of records, and in no case did the number of apparent erroneous entries approach 1% of the observation.

B. METHOD

The method of analysis used in this study was a function of the objective of the study and the data available. In pursuit of the objective, it was decided to select data that would, to the maximum extent, portray the personnel attrition picture of the Marine Corps as it currently exists. Thus, it was deemed important to single out information on very recent discharges, going back in time only in order to provide greater numbers of records, or "observations," so as to give some credence to attrition rates and probabilities determined. This differs from the approach used in most previous studies that have used cohort data, studying what happened over time to the members of a group that

entered during some selected period in the past. The time lag between cohort entry and end of active duty allowed in the studies varies from one to four years, and the discharges occurred throughout that period, predominently during the early portion. The result has been the description of attrition patterns that were occurring up to 3 or 4 years prior to the study date.

The choice in this study, then, was to look at the records of Marines who were recently (FY '75 and '76) discharged for adverse reasons and compare them with the records of all Marines discharged during the same period to determine how this unsatisfactory group differs from the population as a whole. The approach may be thought of as a "cohort-in-reverse" where the cohort has the release date in comman rather than the entry date. Just as many members of a traditional cohort go on beyond many of their contemporaries to serve a full four year term or reenlist to serve more, the members of this discharge cohort entered at a full range of times up to four years previous to discharge date. The discharge population as a whole contains first term discharges for all reasons including completion of enlistment, discharges pursuant to reenlistment, medical discharges, the adverse discharges of interest here, and

others. Thus there is no bias due to exclusion of a particular quality group.

Once the adverse attritions were singled out from the population as a whole, both the adverse group and the entire population were subdivided according to race, education level, mental group (based on Armed Forces Qualification Test percentile score), and age at enlistment, according to the breakdown shown below:

1. Race	Caucasian Non-Caucasian
2. Education Level	Less than H.S. Diploma Graduate Equivalency Diploma (GED) H.S. Diploma or higher
3. Mental Group	Category I or II (score 65-100) Category IIIA (score 51-64) Category IIIB (score 31-50) Category IV (score 0-30)
4. Age	17 18 or 19 20 or older

When these subdivisions were cross-tabulated, the result was 72 groupings or cells. These groupings allowed the calculation of the probability of receiving an adverse discharge for individuals who could be identified as being a member of a particular cell.

The calculation of the numbers of records in each four-subscript subdivision is both voluminous and time-consuming, even with high speed computers. Most statistical packages are not designed to handle such a large number of records

and normally it is necessary to use sampling techniques to estimate the probabilities. Such a sampling scheme, however, was likely to result in many cells with insufficient observations to allow any confidence in the results. The program finally adopted here is titled "XDIM," written by Mr. Dick Wells of the Defense Manpower Data Center, formerly known as the Manpower Research and Data Analysis Center (MARDAC), and was used with permission of that organization. This program is ideally suited for this type of application, tallying the number of records in each of the subdivisions for both the adverse-discharge group and the overall-discharge group.

The calculation of probabilities was very simply done through use of the following formula:

$$P(A)_{i,j,k,l} = \frac{A_{i,j,k,l}}{N_{i,j,k,l}}$$

where P(A) is the probability of adverse discharge, the subscripts i,j,k,l refer to the four variables (race, education level, mental group, and age), "A" is the number of adverse discharges, and "N" is the total number of discharges. The probability of success, of avoiding an adverse discharge, is the complement:

$$P(S) = 1 - P(A)$$

The probability of success is presented in Table II for each subdivision of characteristics.

This same general method was used to investigate whether there are quality differences (as manifested by probability of success) across geographical boundaries, controlling for education level (recognizing that quality of education and that requirements for the GED vary from state to state) and for mental group, another characteristic that has been reported to be an important determinant in success in other studies.

Finally one further investigation was conducted based on the hypothesis that previous studies have failed to detect quality differences across geographic boundaries because the level of aggregation was too high. The use of regions such as East, West, etc., or Northwest, North Central, and Southwest may aggregate very different quality factors of smaller regions to the point where they cancel each other out. The same may also be true of states. Significant quality differences in existence at the county level may be obscured when counties are aggregated to the state level. The last portion of this study thus used the methodology already outlined to examine quality differences across counties within the state of California. California was selected because of its diversity and its large contribution to Marine Corps accessions.

V. RESULTS

The results of the program execution and probability calculations described above are presented as the probability of successfully completing enlistment in Tables II, through VI. In this context, "success" is defined as the avoidance of an adverse discharge and is determined for certain only by the receipt of some more satisfactory discharge. Of the 101,868 discharges examined, 37,287 were adverse, for an overall success rate of 63%. Below is a discussion of how this success measure appears from the tables to be related to each of the variables considered in the analysis.

A. EFFECTS OF THE VARIABLES

1. Race

In general, Table II indicates that whites are more likely to succeed in receiving a satisfactory discharge than are other races, i.e., Negro, Malayan, Mongolian, and American Indian. Differences among these non-white races were not investigated. Although there is considerable variation and, in some otherwise similar subdivisions, non-whites are more likely to be successful than are whites, this appears as the exception to the rule. The apparent advantage of whites over other races is most distinct for

Table II

Probability of Successfully Completing First Enlistment by Race, Education, Mental Group, and Age *

RACE		WHITE			NON-WHITE		
MG	AGE	<HS	GED	HS+	<HS	GED	HS+
	17	.39	.68	.80	.33	.43	.61
I&II	18 & 19	.45	.68	.84	.36	.49	.64
	20+	.49	.58	.81	.37	.49	.60
	17	.43	.73	.80	.31	.57	.60
IIIA	18 & 19	.45	.74	.82	.39	.56	.66
	20+	.46	.63	.76	.40	.59	.64
	17	.48	.69	.74	.40	.56	.79
IIIB	18 & 19	.48	.73	.79	.45	.71	.70
	20+	.44	.65	.72	.45	.62	.71
	17	.60	.78	.76	.56	.65	.75
IV	18 & 19	.66	.75	.79	.61	.75	.81
	20+	.58	.80	.79	.61	.75	.76

* N for each subdivision is shown in Appendix C.
Definition of abbreviations and terms:
White - Caucasian
Non-White - other than Caucasian
MG - mental group
I&II - AFQT percentile scores 65-100
IIIA - AFQT percentile scores 51-64
IIIB - AFQT percentile scores 31-50
IV - AFQT percentile scores 0-30
< HS - less than a High School diploma
GED - graduate equivalency diploma
HS+ - a High School diploma or more

those in the higher mental groups and for high school graduates. For these groupings the difference in probability of success is about 20%.

2. Education

Of all the variables examined, education level has the most significant and most consistent effect on probability of success. In most comparable cells the chances for successfully completing an enlistment for those with a high school degree are from 20% to 40% better than for non-graduates. The position of those with a Graduate Equivalency Diploma is less consistent, but normally falls somewhere between the non-graduates and the graduates. The marginal probabilities of success, not shown in the table, are .46 for those with no degree, .69 for those with a G.E.D., and .79 for the high school graduates. Education level will be discussed further in connection with the results of the state by state analysis.

3. Mental Group

When Table II is examined for the effect of the mental group on success chances, an unexpected result appears. In the discharges studied, those records indicating lower mental groups are more likely to be satisfactory discharges than are the higher mental groups, particularly noticeable in the lowest mental ability grouping, category IV. The

same pattern emerges in almost every age, race, and educational category. This result runs contrary both to intuition and to the results of virtually every known previous study in this area.

Further checking was conducted. Coding of variables was the most obvious potential source of error and these were checked to ensure their correctness. The mental groups were then recoded based on GCT scores to see if some systematic bias was introduced by the deletion by the program of a large percentage of discharge records due to omission or erroneous entry of AFQT score. (AFQT score was read as "unknown" by the program on almost 7% of the records. The percentage of "unknowns" was less than 1% for all other variables.) The use of mental group based on GCT confirmed the original finding.

Finally the distribution of this discharge cohort with respect to mental group was compared with a like distribution of Marine Corps accession records from Fiscal Years 1974, 1975, and 1976. It was discovered that mental group IV Marines make up a much larger proportion of this discharge cohort than they do of the accession group. This evidence coupled with verbal confirmation from Headquarters Marine Corps, that mental group IV Marines are no longer being enlisted, and with evidence that the majority of

adverse personnel attritions occur in the first two years of service [Refs. 1, 10] led to the following interpretation.

The validity of this model for determining probability of success is predicated on the assumption that enlistment policies are fairly steady during the period that the Marines in the study were enlisting, a full four-year period prior to the first discharges (July 1974). If enlistment policies were fairly constant, a steady state would be achieved by the distribution of a "discharge cohort" would be the same as an entry cohort.

In this case the policy regarding the enlistment of mental group IV individuals changed abruptly. The result was that the mental group IV Marines in this group had already completed the first portion of their enlistment, and their chances of success had improved significantly. Thus these results are biased in that they make category IV personnel appear more successful than they really are.

4. Age

Comparison of subdivisions that are otherwise similar indicates that the 18 and 19 year-old enlistees have a slightly better chance of success than do either 17 year-old accessions or those who are 20 or older. Comparison of the youngest and oldest groups is not very revealing.

5. State

Table III presents a state by state breakdown of the probabilities of success for Marines discharged during FY '75 or '76. These probabilities are further broken down by education level and by mental group. In subdivisions in which fewer than thirty Marines were discharged, the probabilities are not reported because they are likely to be misleading. Marginal probabilities across all mental groups are presented for each education level in each state. Z - scores are determined by comparing these marginal probabilities within each state with the corresponding marginal probabilities for the overall population. The normal approximation is appropriate here, and Z is calculated for each educational level in each state as:

$$Z = \frac{P_{s,e} - P_e}{\frac{P_e\,(1-P_e)}{n}}$$

where P_e is the probability of success across all states for a certain education level, (.46 for non-graduates, .69 for GED holders, and .79 for high school graduates), $P_{s,e}$ is the probability of success in the state of interest for that education level, and n is the number of discharges in our sample from that state and educational level.

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Delaware	I&II	.37	--	.88
	IIIA	--	--	.79
	IIIB	.37	--	.62
	IV	--	--	.97
	All MG	.44	--	.85
	Z Score	-1.25	--	2.10
District of Columbia	I&II	.24	--	--
	IIIA	.46	--	--
	IIIB	.47	.70	.72
	IV	.46	--	--
	All MG	.45	.69	.73
	Z Score	-.34	0	-1.83
Florida	I&II	.49	.77	.79
	IIIA	.42	.77	.75
	IIIB	.43	.56	.67
	IV	.64	.81	.84
	All MG	.46	.71	.75
	Z Score	0	.66	-3.05
Georgia	I&II	.32	.48	.72
	IIIA	.35	.72	.74
	IIIB	.45	.60	.63
	IV	.64	.53	.77
	All MG	.44	.61	.71
	Z Score	-1.16	-2.24	-5.38
Hawaii	I&II	--	--	--
	IIIA	--	--	--
	IIIB	--	--	.84
	IV	--	--	--
	All MG	.60	--	.88
	Z Score	1.66	--	2.10
Idaho	I&II	.50	--	.85
	IIIA	.55	--	.89
	IIIB	.64	.77	.94
	IV	.78	--	--
	All MG	.61	.75	.90
	Z Score	5.20	1.15	4.30
Illinois	I&II	.49	.65	.85
	IIIA	.46	.72	.78
	IIIB	.48	.72	.74
	IV	.60	--	.73
	All MG	.49	.70	.79
	Z Score	2.92	.47	0

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Indiana	I&II	.38	.74	.81
	IIIA	.42	.79	.80
	IIIB	.49	.73	.70
	IV	.60	--	.79
	All MG	.46	.75	.77
	Z Score	0	2.12	-1.77
Iowa	I&II	.47	.68	.86
	IIIA	.46	.62	.76
	IIIB	.45	.81	.79
	IV	.70	--	.84
	All MG	.49	.69	.82
	Z Score	1.29	0	1.81
Kansas	I&II	.50	.76	.84
	IIIA	.43	--	.85
	IIIB	.43	--	.77
	IV	.64	--	.90
	All MG	.48	.73	.83
	Z Score	.83	.87	2.36
Kentucky	I&II	.33	.55	.70
	IIIA	.32	.72	.72
	IIIB	.37	.57	.71
	IV	.52	--	.71
	All MG	.36	.63	.71
	Z Score	-5.46	-1.66	1.10
Louisiana	I&II	.48	178	.83
	IIIA	.47	.74	.77
	IIIB	.53	.79	.84
	IV	.64	--	.87
	All MG	.52	.78	.83
	Z Score	3.70	2.68	3.07
Maine	I&II	.27	--	.85
	IIIA	.41	--	.66
	IIIB	.49	--	.76
	IV	.52	--	--
	All MG	.43	.51	.78
	Z Score	.87	-2.99	.39
Maryland	I&II	.42	.74	.82
	IIIA	.38	.78	.77
	IIIB	.53	.65	.76
	IV	.59	--	.79
	All MG	.49	.72	.78
	Z Score	1.76	.85	.83

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Massachusetts	I&II	.43	.85	.83
	IIIA	.34	.79	.80
	IIIB	.46	.85	.75
	IV	.61	--	.78
	All MG	.44	.83	.80
	Z Score	-.31	3.38	.74
Michigan	I&II	.44	.68	.82
	IIIA	.48	.75	.82
	IIIB	.53	.82	.77
	IV	.72	.96	.84
	All MG	.53	.78	.81
	Z Score	6.06	3.99	2.11
Minnesota	I&II	.40	.64	.84
	IIIA	.42	.67	.81
	IIIB	.46	0	.81
	IV	.66	--	.78
	All MG	.44	.48	.82
	Z Score	-1.18	-5.52	2.28
Mississippi	I&II	.42	--	.84
	IIIA	.44	--	.75
	IIIB	.52	--	.72
	IV	.63	--	.83
	All MG	.50	.72	.78
	Z Score	1.54	.52	-.46
Missouri	I&II	.42	.69	.83
	IIIA	.40	.71	.84
	IIIB	.49	.80	.76
	IV	.67	--	.87
	All MG	.48	.74	.81
	Z Score	1.50	1.78	1.61
Montana	I&II	--	--	.90
	IIIA	.34	--	.89
	IIIB	.47	--	.80
	IV	--	--	--
	All MG	.46	.79	.86
	Z Score	0	1.35	2.31
Nebraska	I&II	.50	--	.80
	IIIA	.38	--	.83
	IIIB	.48	--	.75
	IV	.66	--	--
	All MG	.48	.67	.81
	Z Score	.68	-.32	.83

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Nevada	I&II	.55	--	.83
	IIIA	.51	--	.83
	IIIB	.53	--	--
	IV	--	--	--
	All MG	.53	.68	.78
	Z Score	1.70	-.14	-.25
New Hampshire	I&II	--	--	.73
	IIIA	--	--	--
	IIIB	.42	--	.74
	IV	--	--	--
	All MG	.44	.76	.66
	Z Score	-.36	.88	-3.51
New Jersey	I&II	.32	.61	.74
	IIIA	.39	.75	.75
	IIIB	.38	.66	.69
	IV	.57	--	.68
	All MG	.39	.58	.72
	Z Score	-4.71	-3.09	-1.74
New Mexico	I&II	.62	--	.91
	IIIA	.75	--	.85
	IIIB	.59	.78	.92
	IV	.70	--	.82
	All MG	.64	.80	.87
	Z Score	2.60	2.11	4.03
New York	I&II	.35	.64	.74
	IIIA	.37	.68	.71
	IIIB	.41	.68	.67
	IV	.58	.87	.75
	All MG	.41	.68	.71
	Z Score	-5.56	-.50	-8.28
North Carolina	I&II	.36	.60	.79
	IIIA	.38	.81	.74
	IIIB	.45	.80	.77
	IV	.64	--	.86
	All MG	.43	.74	.79
	Z Score	-2.42	1.64	0
North Dakota	I&II	.39	--	.86
	IIIA	.55	--	.76
	IIIB	.38	--	.89
	IV	--	--	--
	All MG	.48	--	.83
	Z Score	.49	--	1.25

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Ohio	I&II	.34	.66	.77
	IIIA	.32	.75	.76
	IIIB	.39	.74	.67
	IV	.54	--	.73
	All MG	.37	.71	.73
	Z Score	-10.62	1.00	-8.66
Oklahoma	I&II	.39	.62	.82
	IIIA	.41	.72	.82
	IIIB	.44	.52	.75
	IV	.72	--	.81
	All MG	.44	.64	.80
	Z Score	-1.11	-1.27	.63
Oregon	I&II	.51	.67	.86
	IIIA	.55	.57	.83
	IIIB	.59	.63	.82
	IV	.64	--	--
	All MG	.57	.64	.84
	Z Score	1.45	-1.21	2.58
Pennsylvania	I&II	.32	.59	.79
	IIIA	.39	.71	.76
	IIIB	.41	.63	.68
	IV	.52	.73	.74
	All MG	.40	.65	.75
	Z Score	-5.71	-1.83	-5.33
Rhode Island	I&II	.40	--	.77
	IIIA	.44	--	--
	IIIB	.51	--	.67
	IV	--	--	.95
	All MG	.48	.68	.75
	Z Score	.52	-.14	-1.15
South Carolina	I&II	.41	--	.83
	IIIA	.46	--	.77
	IIIB	.48	--	.66
	IV	.71	--	.76
	All MG	.50	.87	.74
	Z Score	.62	3.81	-2.63
South Dakota	I&II	--	--	.88
	IIIA	--	--	.81
	IIIB	.35	--	.71
	IV	.50	--	--
	All MG	.41	.55	.81
	Z Score	-1.03	-1.69	.62

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Tennessee	I&II	.37	.55	.86
	IIIA	.35	.89	.74
	IIIB	.36	--	.73
	IV	.66	--	.80
	All MG	.40	.77	.78
	Z Score	2.32	1.965	-.60
Texas	I&II	.49	.62	.84
	IIIA	.57	.64	.81
	IIIB	.54	.64	.82
	IV	.75	.75	.88
	All MG	.43	.65	.83
	Z Score	-2.96	-2.63	5.24
Utah	I&II	.66	--	.87
	IIIA	.50	--	.97
	IIIB	.55	--	.80
	IV	--	--	--
	All MG	.58	.82	.87
	Z Score	.76	1.88	2.50
Vermont	I&II	--	--	.88
	IIIA	--	--	--
	IIIB	--	--	.67
	IV	--	--	--
	All MG	.41	--	.81
	Z Score	-.74	--	.49
Virginia	I&II	.35	.56	.81
	IIIA	.33	.67	.77
	IIIB	.48	.57	.74
	IV	.59	--	.79
	All MG	.43	.58	.77
	Z Score	-1.77	-3.88	-1.48
Washington	I&II	.50	.71	.85
	IIIA	.49	.68	.90
	IIIB	.49	.68	.84
	IV	.66	--	.83
	All MG	.52	.68	.86
	Z Score	2.77	-.08	4.34
West Virginia	I&II	.39	--	.86
	IIIA	.39	.58	.77
	IIIB	.35	.49	.75
	IV	.56	--	.86
	All MG	.39	.53	.80
	Z Score	-3.06	-3.77	.52

STATE	MENTAL GROUP	EDUCATION LEVEL < HS	GED	HS+
Wisconsin	I&II	.44	.51	.84
	IIIA	.40	.65	.85
	IIIB	.48	.75	.78
	IV	.63	--	.83
	All MG	.47	.65	.83
	Z Score	.65	-1.22	3.20
Wyoming	I&II	--	--	.86
	IIIA	--	--	--
	IIIB	--	--	--
	IV	--	--	--
	All MG	.55	--	.81
	Z Score	1.24	--	.42
	I&II			
	IIIA			
	IIIB			
	IV			
	All MG			
	Z Score			
	I&II			
	IIIA			
	IIIB			
	IV			
	All MG			
	Z Score			
	I&II			
	IIIA			
	IIIB			
	IV			
	All MG			
	Z Score			
	I&II			
	IIIA			
	IIIB			
	IV			
	All MG			
	Z Score			
	I&II			
	IIIA			
	IIIB			
	IV			
	All MG			
	Z Score			

Since fifty states and the District of Columbia were examined, considerable variation was expected due to chance alone. In order to determine which, if any, state deviations were of significance (better or worse than the average), the significance level was conservatively set at 5% ($Z=\pm 1.96$). Still, 5% of the 51 states, or 3 states were expected to fall in this critical region owing to chance alone and no difference in personnel quality. Table III indicates that many more than 3 states had Z scores indicating they were significantly different from the average of all states. Those states are listed on Table IV along with their probability of success. Since about 3 states in each educational grouping were expected to fall in this critical region by chance alone, one or two should be deleted from each list, but unless the study were repeated there is no assurance that the right states would be deleted. At any rate, most of the states listed in Table IV exhibit strong variations from the overall average for the education level indicated.

There are a considerable number of management inferences that can be drawn from these tables. First of all, people from different places are likely to be somewhat different in their chances for success in the Marine Corps. Secondly, graduate equivalency diplomas and high school

Table IV

States Exhibiting Significantly Different Success Probabilities[1]

States Significantly Higher	P_s	States Significantly Lower	P_s
Non-graduates			
Michigan	.53	Ohio	.37
Idaho	.61	Pennsylvania	.40
California	.50	New York	.41
Louisiana	.52	Kentucky	.36
Colorado	.53	New Jersey	.39
Illinois	.49	West Virginia	.39
Washington	.52	Texas	.43
		North Carolina	.43
		Tennessee	.40
		Alabama	.42
G.E.D. Holders			
Michigan	.78	Minnesota	.48
South Carolina	.87	California	.62
Massachusetts	.83	Virginia	.58
Connecticut	.79	West Virginia	.53
Indiana	.75	Texas	.65
New Mexico	.80	New Jersey	.58
Tennessee	.77	Maine	.51
		Georgia	.61
High School Graduates			
Idaho	.90	Ohio	.73
Texas	.83	New York	.71
Washington	.86	Georgia	.71
Arizona	.86	Pennsylvania	.75
New Mexico	.87	Alabama	.73
Wisconsin	.83	New Hampshire	.66
Louisiana	.83	Florida	.75
Oregon	.84	South Carolina	.74
Utah	.87	Connecticut	.75
Kansas	.83		
Montana	.86		
Minnesota	.82		
Michigan	.81		
Hawaii	.88		
Delaware	.85		

[1]Listed in order of significance.

diplomas from different states do not always indicate similar probabilities of success. In fact a G.E.D. from a number of states is an equally strong indicator of personnel quality as is a high school diploma from a large number of others. Certainly this potential source of manpower should be viewed accordingly. On the other hand G.E.D. results from some other states indicate personnel quality very little better than would be expected for a non-graduate.

6. County

Table V lists the results obtained when the probability of success was calculated for each educational level in each county in California. Here the results are less informative than the state-by-state breakdown, mainly because the numbers of discharge records for many of the counties were too small. Once again, probabilities were not computed if the total number of discharges at a particular education level in a county was less than 30. The G.E.D. is dropped from the tables because the requirements for the G.E.D. are the same statewide. Counties for which probability figures were not calculated were aggregated based on geographic proximity and the probabilities for the resulting aggregations are presented in Table VI.

Table V

California Counties -
Probability of Successfully Completing First Enlistment*

County	Education Level <HS	HS+
Alameda	.48	.75
Alpine	--	--
Amador	--	--
Butte	--	--
Calaveras	--	--
Colusa	--	--
Contra Costa	.46	.80
Del Norte	--	--
El Dorado	--	--
Fresno	.49	.81
Glenn	--	--
Humboldt	--	--
Imperial	--	--
Inyo	--	--
Kern	.43	.91
Kings	--	--
Lake	--	--
Lassen	--	--
Los Angeles	.52	.82
Madera	--	--
Marin	--	--
Mariposa	--	--
Mendocino	--	--
Merced	--	--
Modoc	--	--
Mono	--	--
Monterey	.49	.71
Nevada	--	--
Orange	.53	.79
Placer	--	--
Plumas	--	--
Riverside	.51	.81
Sacramento	.55	.63
San Benito	--	--

*Probabilities are reported only if the number of discharges in that division was 30 or more.

Table V (Continued)

County	Education Level <HS	HS+
San Bernardino	.49	.79
San Diego	.39	.79
San Francisco	.56	.66
San Joaquin	.58	.82
San Luis Obispo	--	--
San Mateo	.60	.84
Santa Barbara	.52	.75
Santa Clara	.49	.80
Santa Cruz	--	--
Shasta	--	--
Sierra	--	--
Siskiyou	--	--
Solano	--	.79
Sonoma	.51	.67
Stanislaus	.50	.72
Sutter	--	--
Tehama	--	--
Trinity	--	--
Tulare	.49	.67
Tuolomne	--	--
Ventura	.59	.82
Yolo	--	--
Yuba	--	--

Table VI

Success Probabilities in Aggregations of Contiguous California Counties Not Reported Individually

Counties Included	Less Than HS Diploma	HS Diploma or More
Modoc, Lassen, Shasta, Siskiyou, Trinity, Del Norte, Humboldt	.38	.75
Plumas, Butte, Yuba, Sierra, Nevada	.42	.83
Glenn, Tehama, Mendocino, Lake, Colusa, Sutter	.46	.59
Napa, Yolo, Solano	.41	.82
Sonoma, Marin	.51	.72
Placer, El Dorado, Amador, Alpine, Calaveras, Tuolomne, Mariposa	.54	.76
Stanislaus, Merced	.46	.69
Santa Cruz, Monterey, San Benito	.46	.75
Fresno, Madera, Kings	.48	.81
Mono, Inyo, Tulare	.49	.70
Imperial, San Diego	.39	.79

Z - scores were again computed for each subdivision. Of all the counties and aggregations examined, only the following results were significant at the .05 level:

County	Education Level	Z	P(S)
Sacramento	High School Graduates	-5.23	.63
San Diego	Non-graduates	-3.63	.39
Los Angeles	High School Graduates	+3.30	.82
Kern	High School Graduates	+2.51	.91

It should be noted, however, that the probabilities vary throughout Tables V and VI in a fashion similar to the state-by-state analysis. If these probabilities hold up, as they might well do as the number of observations increases, they would become significant. The power of the analysis is lost by insufficient observations. Other than the above results, which could lead to some useful management inquiries (especially with respect to the surprising San Diego result), the county analysis is not conclusive.

B. DISCUSSION

The effect of abrupt policy changes on the usefulness of this analysis has already been discussed. Accordingly, Table I is not sufficiently accurate for use as an "Odds for Effectiveness" tool. The results are susceptible to

the introduction of error by past manpower policy initiatives particularly where those policies are directed at solving the problem currently under study. However, for variables not affected by such major policy shifts, the results should be accurate and a good indicator of what might constitute or contribute to personnel quality. It is believed that the variables other than mental group have not been materially affected by policy changes. The one possible exception to this is the accession policy with respect to education level. The percentage of non-high school graduates in enlisted accessions was decreased from about 50% in FY '75 to about 33% in FY '76. The effects this policy change would have on the data would be to lower slightly the attrition rate for non-graduates, thus raising their probability of success as determined here. Since the success probabilities shown in the tables for non-graduates are so much lower than the like figures for graduates, the effect of any such bias, if present, is inconsequential.

Certainly other possible sources of error are present in the data itself. Numerous records were read as "unknown" by the programs because of improperly entered data. It is logical to assume that numerous other data entries were easily read but were, in fact, incorrect. There is no

reason to believe, however, that these data errors resulted in systematic bias of the results.

Instructions for the coding of the G.E.D. in Manpower Management System files are presented in Reference 17 but are not entirely lucid, and it is not certain that the G.E.D. entry is a condition that existed at the time of enlistment rather than acquired during the enlistment. This study adopted a strict interpretation of Reference 17, regarding only a "Certificate of High School Equivalency" as a G.E.D. G.E.D.'s shown on the file examined were assumed to exist prior to entry into the service. If an appreciable number of them were acquired during the enlistment, the effect would most likely be to bias success probabilities upwards for G.E.D. holders. The variance between states, however, is not likely to be affected.

State and county entries on records have been reported as subject to question. The entry is home of record and this is sometimes interpreted differently at the working level. It may refer to where the individual is living at time of enlistment (as intended) or it may indicate the enlistee's parents' address or "where he hails from." Any such differences, if present, are thought not to materially affect the results.

In the state and county analysis, no attention to race was explicitly made because of time constraints. It should be remembered that since Table II indicated some difference between success probabilities based on race alone, varying racial balances in the accessions from the various states may be responsible for some of the differences reported among the states. This factor is worthy of consideration.

We have discussed the significance of some of the results obtained. It seems appropriate to discuss significance versus usefulness. The probabilities singled out in Table IV as significant are classified as such because of a combination of their differences from the overall mean and the number of discharges upon which the probability for this subdivision was calculated. Thus a very small difference may be significant if the number of discharges in a cell was great enough. Such knowledge is likely to be less useful by a manager, though, than a larger difference from the mean based on a smaller number of discharges. In fact the results of some cells may be useful to a manager even though the number of observations is too small to be termed significant at the 5% level. The reason for reporting the Z - scores and significant states and counties is to show that there are definite differences in personnel quality

across geographical boundaries beyond the amount expected due to chance alone.

The tables and results reported here are open to further analysis, interpretation and criticism. Their usefulness should be enhanced by a close relationship with the Marine Corps manpower situation and with a knowledge of the area under study.

VI. CONCLUSIONS

The results of most of the past efforts at examining this personnel attrition problem are confirmed in general terms. The major additional finding is that there are definite differences in personnel quality as manifested by receipt of a satisfactory discharge among the states, especially when controlling for education level. In the interest of personnel quality it is logical to consider these differences when allocating recruiting assets and determining recruiting goals by area. Thus if it is necessary to accept an increased number of G.E.D. holders because the available supply of high school graduates is insufficient, it is much more sensible to take them from Massachusetts or South Carolina than from Minnesota or Maine. By the same token, non-graduates from Michigan and Idaho are preferable to those from Ohio or Kentucky. The overall force improvement may be marginal, but it is undoubtedly worth the effort. Enlisted manpower quality and its impact on readiness have been too long overlooked.

The quality factors for geographical areas are worthy of consideration in the allocation of recruiting assets. Geographical differences in propensity to enlist have been

looked at time and again with only modest results. The overall recruiting allocation problem will only be solved when the propensity issue is combined with the quality issue. This study was not conclusive in determining what quality differences exist at the local (county) level because of insufficient data. But it is quite possible that they do exist and the potential contribution to personnel effectiveness makes the study worth substantial further effort.

The combination of recruiter productivity, in terms of numbers of enlistees, and a measure of personnel quality of the enlistees, both for each specific area, should be the measure of effectiveness of both the recruiter and the area, and this should be the decision rule for allocating recruiting resources. Here, expected mean time of service until discharge was not examined, but this may be a useful way of translating the recruiter's (or the area's) effectiveness into quantifiable terms. The result is a measure by recruiter (or area) of man-years of service recruited per dollar of recruiting effort. Implicit in the algorithm should be some penalty cost for adverse personnel discharges (failures). An accurate and comprehensive estimate of such cost, including opportunity costs and impact on unit morale and effectiveness, as well as the accounting costs involved, is an effort that can be made only with a judicious

application of subjectivity. But some such attempt should be made in order to protect the service from the effects of the suboptimization that results if personnel quantity is pursued at the expense of quality.

Current Marine Corps policy recognizes the quality problem; it is the reason for the recent policies of increasing the percentage of high school graduates and eliminating mental group IV men in Marine Corps accessions. However, the final solution to the overall cost-effectiveness and resource allocation problem must include some notion of geographical differences in quality as well as in propensity to enlist. This study has used rough measures and has merely scratched the surface. The problem is worthy of further study.

APPENDIX A

Separation Program Designators Considered as Adverse

The following separation program designators (SPD's) are considered in this study to be indicative of adverse personnel attrition:

BFS1
DFS1
JFG8
KFS1
JJC1
JJC2
JJD1
JJD2

Also, any SPD beginning with:

BK
BL
BM
GK
GL
GM
HK
HM
JK
JL
JM

```
IDENTIFICATION DIVISION.
PROGRAM-ID.      ATNUCODE.
AUTHOR.          R A PACKARD, CAPT, USMC.
INSTALLATION.    NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA.
DATE-WRITTEN.    NOV 1976.
DATE-COMPILED.   NOV1976.
SECURITY.        UNCLASSIFIED.
REMARKS.         THIS PROGRAM TRANSFERS EXTRACTS OF RECORDS OF
                 1ST-TERM ENLISTED MARINES WHO LEFT ACTIVE DUTY IN
                 FY-1975 OR FY-1976 FROM A TRS TAPE PROVIDED BY
                 HQMC TO ANOTHER TAPE, IN ORDER TO FACILITATE DATA
                 ANALYSIS.  COMP-3 IS USED TO EXPAND "PACKED" NU-
                 MERICS.  OLD EDUCATION AND STATE HOME OF RECORD
                 CODES ARE UPDATED FOR CONSISTENCY PURPOSES.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER. IBM-360.
OBJECT-COMPUTER. IBM-360.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    SELECT PERS-FIL ASSIGN TO UT-S-TAPIN.
    SELECT ATTRITION-LIST ASSIGN TO UT-S-TAPEOUT.
DATA DIVISION.
FILE SECTION.
FD   PERS-FIL
    RECORD CONTAINS 240 CHARACTERS
    BLOCK CONTAINS 10 RECORDS
    LABEL RECORDS ARE STANDARD
    DATA RECORD IS PERS-REC.
01   PERS-REC.
    02   FILLER          PIC  XX.
    02   ACTNDATE        PIC S9(7), COMP-3.
    02   FILLER          PIC  X.
    02   LENENL          PIC  X.
    02   RACE            PIC  X.
    02   FILLER          PIC  XX.
    02   SSAN            PIC  X(9).
    02   FILLER          PIC  X(35).
    02   LASTMOS         PIC  XX.
    02   FILLER          PIC  X(14).
    02   BIRTHDAY        PIC  S9(7), COMP-3.
    02   FILLER          PIC  X(17).
    02   LASTRUC         PIC  XXXXX.
    02   LASTMCC         PIC  XXX.
    02   FILLER          PIC  X(12).
    02   NUMDEPS         PIC  99, COMP-3.
    02   FILLER          PIC  XXXX.
    02   CIVEDCODE       PIC  XXX.
```

```
    02  FILLER              PIC  XXXXX.
    02  HOMECNTY            PIC  XXX.
    02  FILLER              PIC  X.
    02  XSTATE              PIC  XX.
    02  HOMSTATE  REDEFINES XSTATE  PIC  99.
    02  FILLER              PIC  X.
    02  ENTRY-DATE          PIC  S9(7), COMP-3.
    02  FILLER              PIC  X(54).
    02  PROGENL             PIC  X.
    02  FILLER              PIC  XX.
    02  SEPCODE             PIC  XXXX.
    02  FILLER              PIC  X(22).
    02  GCT                 PIC  S9(2), COMP-3.
    02  FILLER              PIC  XXX.
    02  AFQT                PIC  XX.
    02  FILLER              PIC  X(6).
    02  CYC-DATE            PIC  S9(7), COMP-3.
    02  FILLER              PIC  XXX.
FD  ATTRITION-LIST
    LABEL RECORDS ARE STANDARD RECORD CONTAINS 92 CHARACTERS
    BLOCK CONTAINS 10 RECORDS DATA RECORD IS DROP-REC.
01  DROP-REC                PIC  X(92).
WORKING-STORAGE SECTION.
77  COUNTER                      PIC 9(6), VALUE ZEROS.
01  WS-WORK-REC.
    02  SSAN                PIC  X(9)      VALUE ZEROES.
    02  FILLER              PIC  XXXXX     VALUE SPACES.
    02  ENTRY-DATE          PIC  9(6)      VALUE ZEROES.
    02  ACTNDATE            PIC  9(6)      VALUE ZEROES.
    02  FILLER              PIC  XX        VALUE SPACES.
    02  SEPCODE             PIC  XXXX      VALUE SPACES.
    02  FILLER              PIC  X         VALUE SPACES.
    02  LENENL              PIC  X         VALUE SPACES.
    02  FILLER              PIC  X         VALUE SPACES.
    02  RACE                PIC  X         VALUE SPACES.
    02  LASTMOS             PIC  XX        VALUE SPACES.
    02  FILLER              PIC  XX        VALUE SPACES.
    02  LASTRUC             PIC  XXXXX     VALUE SPACES.
    02  LASTMCC             PIC  XXX       VALUE SPACES.
    02  FILLER              PIC  XXX       VALUE SPACES.
    02  FIRSTRUC            PIC  XXXXX     VALUE SPACES.
    02  PROGENL             PIC  X         VALUE SPACES.
    02  FILLER              PIC  XXXXXX    VALUE SPACES.
    02  AFQT                PIC  XX        VALUE SPACES.
    02  GCT                 PIC  999       VALUE ZEROES.
    02  WS-EDCODE           PIC  XXX       VALUE SPACES.
    02  FILLER              PIC  XXXX      VALUE SPACES.
    02  WS-STATE            PIC  99        VALUE ZEROES.
```

```
           02  HOMECNTY          PIC  XXX      VALUE SPACES.
           02  BIRTHDAY          PIC  9(6)     VALUE ZEROES.
           02  NUMDEPS           PIC  99       VALUE ZEROES.
           02  FILLER            PIC  XXXX     VALUE SPACES.

       PROCEDURE DIVISION.

       OPEN-FILES.
           OPEN INPUT PERS-FIL, OUTPUT ATTRITION-LIST.
       READ-MOVE-AND-CHECK.
           READ PERS-FIL AT END GO TO COMPLETION-ROUTINE.
           MOVE SPACES TO LENENL OF WS-WORK-REC RACE OF WS-WORK-REC
                LASTMOS OF WS-WORK-REC LASTRUC OF WS-WORK-REC LASTMCC
                OF WS-WORK-REC  AFQT   OF WS-WORK-REC WS-EDCODE HOMECNTY
                OF WS-WORK-REC PROGENL OF WS-WORK-REC SEPCODE OF
                WS-WORK-REC.
           MOVE ZERO TO WS-STATE ACTNDATE OF WS-WORK-REC BIRTHDAY OF
                WS-WORK-REC ENTRY-DATE OF WS-WORK-REC GCT OF WS-WORK-REC
                NUMDEPS OF WS-WORK-REC.
           MOVE CORRESPONDING PERS-REC TO WS-WORK-REC.
           MOVE HOMSTATE TO WS-STATE.
           IF CYC-DATE < 760324 THEN GO TO CHANGE-ED-CODE.
           MOVE CIVEDCODE TO WS-EDCODE.
           GO TO FINISH-RECORD.

       CHANGE-ED-CODE.
           IF CIVEDCODE = 101 MOVE 011 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 102 MOVE 021 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 103 MOVE 031 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 104 MOVE 041 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 105 MOVE 051 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 106 MOVE 061 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 107 MOVE 071 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 108 MOVE 081 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 109 MOVE 091 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 110 MOVE 101 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 111 MOVE 111 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 112 MOVE 122 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 199 MOVE 123 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 201 MOVE 011 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 202 MOVE 021 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 203 MOVE 031 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 204 MOVE 041 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 205 MOVE 051 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 206 MOVE 061 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 207 MOVE 071 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 208 MOVE 081 TO WS-EDCODE GO TO ED-CODE-DONE.
           IF CIVEDCODE = 209 MOVE 091 TO WS-EDCODE GO TO ED-CODE-DONE.
```

```
            IF CIVEDCODE = 210 MOVE 101 TO WS-EDCODE GO TO ED-CODE-DONE.
            IF CIVEDCODE = 211 MOVE 111 TO WS-EDCODE GO TO ED-CODE-DONE.
            IF CIVEDCODE = 212 MOVE 124 TO WS-EDCODE ELSE MOVE 122 TO
              WS-EDCODE.
        ED-CODE-DONE.
            IF CYC-DATE < 750723 THEN GO TO CHANGE-STATE-CODE.
            GO TO FINISH-RECORD.
        CHANGE-STATE-CODE.
            IF XSTATE = '  ' MOVE 99 TO WS-STATE GO TO FINISH-RECORD.
            IF HOMSTATE > 02 COMPUTE WS-STATE = HOMSTATE + 1 ELSE GO TO
              FINISH-RECORD.
            IF HOMSTATE > 05 COMPUTE WS-STATE = HOMSTATE + 2 ELSE GO TO
              FINISH-RECORD.
            IF HOMSTATE > 11 COMPUTE WS-STATE = HOMSTATE + 3 ELSE GO TO
              FINISH-RECORD.
            IF HOMSTATE > 39 COMPUTE WS-STATE = HOMSTATE + 4 ELSE GO TO
              FINISH-RECORD.
            IF HOMSTATE > 47 COMPUTE WS-STATE = HOMSTATE + 5.
        FINISH-RECORD.
            WRITE DROP-REC FROM WS-WORK-REC.
            COMPUTE COUNTER = COUNTER + 1.
            GO TO READ-MOVE-AND-CHECK.
        COMPLETION-ROUTINE.
            DISPLAY COUNTER.
            CLOSE PERS-FIL WITH DISP.
            CLOSE ATTRITION-LIST WITH DISP.
            STOP RUN.
//GO.TAPIN DD UNIT=3400-3,DSNAME=D.C1081.P05.PAC-SE,
//    DCB=(RECFM=FB,LRECL=240,BLKSIZE=2400),
//    VOL=SER=I02341,DISP=(OLD,KEEP),LABEL=(1,SL)
//GO.TAPEOUT DD UNIT=3400-3,DSNAME=S1237.DROP,
//    DCB=(RECFM=FB,LRECL=92,BLKSIZE=920,DEN=3),
//   VOL=SER=NPS178,DISP=(NEW,KEEP),LABEL=(1,SL)
```

```
            NOTE:  THIS IS THE SET OF CONTROL STATEMENTS USED TO OBTAIN THE
                   RESULTS PRESENTED IN THIS STUDY USING THE PROGRAM "XDIM".
                   THE "IF" STATEMENT WAS USED TO SELECT CALIFORNIA RECORDS ONLY
                   AND WAS ACTUALLY USED SEPARATELY FROM THE XDIM STATEMENTS
                   SHOWN ABOVE IT HERE.  THE CONVT STATEMENTS WERE USED TO CON-
                   VERT ZONED DECIMAL NUMERALS TO BINARY.
//    EXEC XDIMTST,FLTYP='FILE=MCEL LRECL=92',MEMBER='XDIM2',DEST='A',
//   REGION.LKED2=180K
//GO1.SYSPRINT DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=133,
//    BUFNO=1),SPACE=(CYL,(3,1))
//GO1.FLPAR1 DD *
N='MCEL';
N='FIRST' P=1 W=1 R=9;
N='END';
SLASH-STAR
//GO1.SYSIN DD *
CONVT Z_ENTY1=(15,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9:);
CONVT Z_ENTY2=(16,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9:);
COMPUTE Z_ENTY=10*Z_ENTY1+Z_ENTY2;
N='Z_ENTY' R=76;
CONVT Z_ENTM1=(17,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9:);
CONVT Z_ENTM2=(18,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9:);
COMPUTE Z_ENTM=10*Z_ENTM1+Z_ENTM2;
N='Z_ENTM' R=12;
CONVT Z_RACE=(36,1,C)(1=C:2=N:3=A:4=M:5=X);
N='Z_RACE' R=5;
RECODE Z_RAC=Z_RACE(1=1:2=2-5);
N='Z_RAC' R=2 T='RACE' L(1)='CAUC' L(2)='OTHER';
CONVT Z_AFQT1=(64,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
CONVT Z_AFQT2=(65,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9)
COMPUTE Z_AFQT=10*Z_AFQT1 + Z_AFQT2;
N='Z_AFQT' R=99;
RECODE Z_GRP=Z_AFQT(1=65-99:2=51-64:3=30-50:4=1-30);
N='Z_GRP' R=4 T='MENTAL GROUP' L(1)='I&II' L(2)='IIIA' L(3)='IIIB' L(4)='LEIV';
CONVT Z_ED=(71,1,C)(1=1:2=5:3=2:4=4:5=A:6=D:7=K:8=N:9=R:10=U:11=W:12=3);
N='Z_ED' R=12;
RECODE Z_HYEC=Z_ED(1=1-2:2=3-11:3=12);
N='Z_HYEC' R=3 T='EDUCATION' L(1)='<HS' L(2)='>=HS' L(3)='GED';
CONVT Z_ST1=(76,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
CONVT Z_ST2=(77,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
COMPUTE Z_ST=10*Z_ST1+Z_ST2;
CONVT Z_CT1=(78,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
N='Z_ST' R=99 T='HOR';
CONVT Z_CT2=(79,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
CONVT Z_CT3=(80,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
COMPUTE Z_COUNT=100*Z_CT1 + 10*Z_CT2 + Z_CT3;
N='Z_COUNT' R=999 T='COUNTY';
CONVT Z_BTHY1=(81,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
```

```
CONVT Z_BTHY2=(82,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
COMPUTE Z_BTHY=10*Z_BTHY1 + Z_BTHY2;
N='Z_BTHY' R=99;
CONVT Z_BTHM1=(83,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
CONVT Z_BTHM2=(84,1,C)(0=0:1=1:2=2:3=3:4=4:5=5:6=6:7=7:8=8:9=9);
COMPUTE Z_BTHM=10*Z_BTHM1 + Z_BTHM2;
N='Z_BTHM' R=99;
COMPUTE Z_AGE=((12*Z_ENTY+Z_ENTM)-(12*Z_BTHY+Z_BTHM))/12;
N='Z_AGE' R=99;
RECODE Z_AGES=Z_AGE(1=17:2=18,19:3=20-99);
N='Z_AGES' R=3 T='AGE AT ENTRY' L(1)='17' L(2)='18-19' L(3)='>=20';
XDIM Z_HYEC Z_AGES Z_RAC;
LIST Z_GRP;
END;
XDIM Z_HYEC Z_GRP;
LIST Z_ST;
END;
IF (Z_ST=06);
XDIM Z_HYEC Z_GRP;
LIST Z_COUNT;
END;
FINISH;
SLASH-STAR
//PL1L2.SYSPRINT DD SYSOUT=A
SLASH-STAR
//GO2.WKF1  DD  SPACE=(TRK,(100,100)),VOL=SER=SPOOL1,UNIT=2314
//GO2.WKF2  DD  SPACE=(TRK,(100,100)),VOL=SER=SPOOL2,UNIT=2314
//GO2.WKF3  DD  SPACE=(TRK,(100,100)),VOL=SER=SPOOL3,UNIT=2314
//GO2.WKF4  DD  SPACE=(TRK,(100,100)),VOL=SER=SPOOL1,UNIT=2314
//GO2.WKF5  DD  SPACE=(TRK,(100,100)),VOL=SER=SPOOL2,UNIT=2314
//GO2.DATA DD UNIT=3400-3,DISP=(OLD,KEEP),
//   DSN=S1237.XDRP,VOL=SER=NPS159,
//    DCB=(RECFM=FB,LRECL=92,BLKSIZE=920,DEN=3)
//
```

APPENDIX C

Number of Discharges in Each Subdivision
Reported on in Table II

RACE		WHITE			NON-WHITE		
MG	AGE	<HS	GED	HS+	<HS	GED	HS+
I&II	17	3557	1227	1363	511	51	79
	18 & 19	2741	1059	8528	625	70	585
	20+	948	379	3274	284	51	416
IIIA	17	4256	1135	903	765	75	131
	18 & 19	3173	890	5187	942	121	857
	20+	852	299	1557	417	63	545
IIIB	17	5835	1207	1094	1357	204	393
	18 & 19	6223	1110	6119	2679	290	2306
	20+	1729	328	1894	1104	152	1384
IV	17	453	105	267	117	34	150
	18 & 19	2254	1237	1755	1199	120	1310
	20+	587	60	585	502	56	735

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